5.3.3 Flashing Operation

For flashing operation, the national MUTCD 2000 (Section 4K.2) defines the signal as "a highway traffic signal with one or more signal sections that operates in flashing mode. It can provide traffic control when used as an intersection control beacon or warning in alternative uses". It further states:

> Application of intersection control beacon indication shall be limited to the following:
>
> a. Yellow on one route (normally the major roadway) and red for the remaining approaches.
> b. Red for all approaches (if the warrant for a multi-way STOP is satisfied).
>
> Flashing yellow indications shall not face conflicting vehicular approaches.

The FHWA *Traffic Control Devices Handbook* (TDCH) states "Flashing yellow/red may be appropriate at simple, four-legged or three-legged intersections where the minor-street drivers have an unrestricted view of approaching main street traffic, and the traffic volumes are low."

There are several factors that should be considered when applying flashing operation. Some of these are: traffic volume, traffic volume as a percentage of signal warrant, time of day, accidents and day of the week. Although flashing operation is used, few agencies have evaluated its effectiveness. The following is a summary of findings from reviewing available literature and discussions with other jurisdictions across the country.

- The basis for selecting the mode of flashing operation (yellow/red or red/red) varies among agencies. Factors often considered by agencies in selection flashing mode are volumes, volume to capacity (v/c) ratios, accident history, consistency with other flashing signals, geometrics and sight distance, speed, and engineering judgment. Due to possible incorrect driver perception, it is not recommended that intersections operate with yellow/red operation. If flashing operation is implemented, red/red operation should be deployed.

- Some agencies delay the start of flashing operation on Thursday through Saturday night one-hour after nightclubs have closed.

- If side street visibility is good, the signal can be flashed during periods of time when the anticipated volume of traffic is low and when that volume can be more efficiently served by a flashing, rather than a cycling operation.

- If the side street visibility is marginal and requires side street drivers facing a flashing red display to pull up past the stop bar to achieve good visibility, yet not into the main street lanes, flashing should be reserved for periods of extremely low traffic flow.

- If side street drivers facing a flashing red display must pull into the main street lanes to see main street traffic, flashing operation is not recommended and should be reserved for signal malfunction and emergency pre-emption only.

- If a check of records reveals that a flashing operation has resulted in an increase of more than two accidents during the late night hours, that signal should be taken out of scheduled flash.

- Flashing operation is not recommended at intersections with dual left-turn lanes.

Through simulation studies conducted by various agencies, it has been found that flashing operation is beneficial in generally reducing vehicular delays at signalized, non-actuated intersections during the late night hours. In addition, flashing operation has shown to reduce electric energy consumption during the same late night hours. A typical intersection with four approaches, permissive left-turn movements and three vehicle signals per approach (assuming three section heads per signal) has a total of 36 signal heads (lamps). With two pedestrian signal heads per direction (total 8 pedestrian heads per intersection), a typical intersection would consume 5.34 kW of energy per hour (36 vehicle lamps on at any one time x 135 watts per lamp + 8 pedestrian lamps on at any one time x 60 watts per lamp). During the hours of 12AM and 5AM, the energy consumption would be approximately 812 kW per month. If the same intersection was to operate under flashing mode, pedestrian heads would be turned off and only half of the vehicle signal heads would be on at any one time. With flashing operation, 18 vehicle lamps will be on at any one time (total 36 signal heads at 50% on at any one time due to flashing operation). This will result in an energy consumption of 2.43 kW per hour (18 lamps x 135 watts per lamp). During the flashing hours of 12AM and 5AM, the energy consumption would be approximately 370 kW per month. The total energy savings for five hours would be approximately 442 kW per month. With an average cost of $0.05 per kW, the total cost savings would be approximately $22 per month, per intersection ($265 per year, per intersection).

From reviewing available literature and from discussions with various agencies, flashing operation has been found to have negative impacts. Some of the negative impacts are:

- Right-angle accidents were significantly higher with flashing signal operations.

- A motorist facing a flashing red display may assume the opposing traffic signal to also display a flashing red, although a flashing yellow could be displayed.

- Some motorists may not know how to react to a flashing yellow and may stop, increasing the risk of rear-end crashes.

- During flashing operation, pedestrian beacons are turned off. Pedestrians would then need to find an acceptable gap in traffic and cross the street. This results in a hazardous situation especially on wider crossings.

- On one-way streets, such as those in the downtown Lincoln area, pedestrians walking the opposite direction of the flow of traffic, may be unaware of the type of intersection operation. With pedestrian beacons turned off (which occurs during flashing mode) and no vehicular signal head, pedestrians are unaware of the operation of the intersection.

A 1998 study conducted in San Francisco, California by the San Francisco Department of Parking and Traffic showed that even though city-wide overall collisions had increased, there was a 25 percent decrease in the number of injury accidents at intersections in which flashing operation had been removed during the late night periods.